

## SECTION 101

### TESTS AND TRIALS

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| 12 | (101A)       | SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS                                |    |
| 13 |              | TECHNICAL AND RESEARCH BULLETIN NO. 3-39, <i>Guide for Shop and</i>             |    |
| 14 |              | <i>Installation Tests</i> - 1985  |    |
| 15 | (101B)       | MARITIME ADMINISTRATION SUPPLEMENTARY PROCEDURE FOR                             |    |
| 16 |              | TESTING MACHINERY, dated SEPTEMBER 1, 1977                                      |    |
| 17 | (101C)       | IEEE STANDARD 45-1983, <i>IEEE Recommended Practice for Electric</i>            |    |
| 18 |              | <i>Installations</i>  |    |
| 19 | (101D)       | AMERICAN BUREAU OF SHIPPING, <i>Rules for Building and Classing Steel</i>       |    |
| 20 |              | <i>Vessels</i>  |    |
| 21 | (101E)       | USCG NVIC 17-91, GUIDELINES FOR CONDUCTING STABILITY                            |    |
| 22 |              | TESTS/ASTM F1321, <i>Standard Guide for Conducting a Stability Test</i>         |    |
| 23 |              | <i>(Lightweight Survey and Inclining Experiment) to Determine the Lightship</i> |    |
| 24 |              | <i>Displacement and Centers of Gravity of a Vessel</i>                          |    |
| 25 | (101F)       | SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS                                |    |
| 26 |              | TECHNICAL AND RESEARCH (SNAME) - BULLETIN NO. 3-47, <i>Guide</i>                |    |
| 27 |              | <i>for Sea Trials</i> - 1989  |    |
| 28 | (101G)       | CODE OF FEDERAL REGULATIONS, Chapter 33   |    |
| 29 | (101H)       | CODE OF FEDERAL REGULATIONS, Chapter 46   |    |
| 30 | (101I)       | <b>VOLUME V, OWNER - FURNISHED EQUIPMENT</b>                                    |    |

## 101.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements for tests and trials necessary to demonstrate that the Vessel is complete and complies with the Technical Specification and related Contract documents in every respect. This Section is supplemented by requirements stated in other Sections of the Technical Specification.

*For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.*

## 101.3 GENERAL

All systems, equipment, machinery, and components installed by the Contractor or WSF vendors shall be tested to demonstrate satisfactory workmanship, operation, and compliance with the requirements, intent, and substance of the Contract, Technical Specification, and Authoritative Agency requirements.

Unless noted otherwise in this Section or specific Sections of the Technical Specification, the Contractor is responsible for the preparation of **all** Test Procedures for **all** testing required by the Technical Specification, including testing of Owner - Furnished Equipment (OFE) and the testing required by Authoritative Agencies.

Tests and Trials shall satisfy the requirements of the applicable codes of the Society of Naval Architects and Marine Engineers (SNAME) except as noted in this Technical Specification. Shop and installation tests shall be in accordance with References (101A), (101B), and (101F). Should any conflicts and/or contradictions exist between these codes, the Maritime Administration procedure, Reference (101B), shall take precedence. Should conflict exist between the Technical Specification and Reference (101B), the Technical Specification shall take precedence.

Unless noted otherwise in specific Sections of the Technical Specification, the Contractor shall provide **all** required test instrumentation, fuels, lubricants, fluids, data recording and equipment operator personnel including vendor personnel necessary to perform all tests and trials. Just prior to each Vessel being completed and delivered to WSF, the Contractor shall, at its sole expense, fill and top off lubricant storage tanks, including equipment sump fluid levels, with clean new fluids. Fuel oil utilized for tests and trials shall be compatible with WSF's type of fuel currently in use in the WSF Fleet. All lube oil shall be the type and grade as currently supplied to WSF under the existing WSF supplier contract – **no exceptions**.

Unless noted otherwise in specific Sections of the Technical Specification, testing shall be conducted using only Test Procedures developed by the Contractor and approved by the WSF Representative and the cognizant Authoritative Agencies, where required. ***No testing shall be conducted without an approved Test Procedure.*** All installation check points and

1 measurements required in this Technical Specification for a particular system or machine  
2 shall be performed, recorded and a copy provided to the WSF Representative prior to the  
3 start of any approved test procedure on that system or machine.

4 The Contractor shall develop and update a Test Schedule, as set forth in the *TEST*  
5 *SCHEDULE* Subsection in this Section of the Technical Specification, that shall be fully  
6 integrated into the Master Construction Schedule.

7 When all individual tests have been satisfactorily completed and all defects directly related to  
8 the safe operation of the Vessel's equipment, or the safety of personnel, have been corrected,  
9 Dock Trials shall be conducted to demonstrate the Vessel's readiness for sea.

10 Upon successful completion of Dock Trials, and when all defects directly related to the safe  
11 operation of the Vessel, its equipment, or to the safety of personnel have been corrected,  
12 Preparatory Sea Trials shall be conducted. After successful completion of Preparatory Sea  
13 Trials, Sea Trials shall be conducted to demonstrate that the Vessel is ready for the  
14 unrestricted service for which it was designed and built.

#### 15 **101.4 TEST PROCEDURES**

16 Unless directed otherwise in the Technical Specification, the Contractor shall provide  
17 approved Test Procedures covering installation and operational testing of all equipment and  
18 systems throughout the Vessel. The Contractor shall use these approved Test Procedures for  
19 all testing and recording of test results for acceptance and Authoritative Agencies approvals.

20 Where the words "test procedure(s)" and/or "test memorandum(s)" are used in this Section  
21 and other Sections of the Technical Specification, they shall be considered synonymous.

##### 22 **101.4.1 WSF Example Test Procedures**

23 WSF will make available as a guide, "WSF Example Test Procedures" upon request by  
24 qualified Proposers. These procedures show the minimum level of testing requirements  
25 acceptable to WSF, but do not contain testing requirements for all tests required by the  
26 Technical Specification, nor are they necessarily complete, nor have they been approved  
27 by Authoritative Agencies.

28 The Contractor shall use the WSF Example Test Procedures to establish the minimum  
29 level of testing required by this Technical Specification. The Contractor can modify  
30 these procedures, as required, to suit the Vessel's system, equipment, machinery, or  
31 component to be tested. During this modification process, the Contractor shall use  
32 References (101A), (101B), (101C) and (101D) for guidance, and shall include any tests  
33 and demonstrations required to show compliance with the Authoritative Agency  
34 requirements. The Contractor shall also include all expected results or values anticipated  
35 for a satisfactory test or demonstration on each test procedure's data sheet, and add any

applicable drawing notes, or technical manual warnings or cautions, to the test procedure's "**METHOD**" section.

Test Procedures developed by the Contractor shall, at a minimum, contain the same level of detail as the WSF Example Test Procedures.

All Test Procedures shall be produced using upper and lower case, text similar to this Technical Specification. Test Procedures **shall not** be produced in all upper case text.

The appropriate Contractor personnel shall sign the cover sheet indicating who prepared the test procedure for submittal, who reviewed the test procedure prior to submittal, and who approved the test procedure for use.

The test procedure shall then be submitted to the WSF Representative for review and approval not less than thirty (30) days prior to the beginning of the test. WSF shall be allowed fifteen (15) days for review. As set forth in the *MASTER DRAWING SCHEDULE (MDS) AND PREPARATION* Subsection in Section 100 of the Technical Specification for drawings, mass submittals of new and/or re-submitted test procedures may delay review and return of the procedures and **shall be no cause** for any claim by the Contractor.

The WSF Representative shall indicate approval of the test procedure for use by signing the "**TEST PROCEDURE APPROVED FOR USE**" block on the test procedure cover sheet, and return the test procedure to the Contractor. The Contractor shall then provide the WSF Representative with two (2) paper copies and one (1) copy on CD-Rom or DVD-ROM format, and the Authoritative Agency with one (1) paper copy of the approved test procedure.

If a change in the scope of Work occurs during the course of the Contract, which alters the test requirements of a WSF approved Test Procedure, the Contractor shall revise and resubmit that Test Procedure. The change shall be made to the method and data sheet sections of the Test Procedure and a brief narrative of the change entered on the revision page. Each page receiving a revision, as well as the cover page, shall have an alpha character placed in the revision block reflecting the level of revision. The Test Procedure shall then be resubmitted to the WSF Representative for review and revision approval.

#### **101.4.2 Contractor Furnished**

The failure of WSF, or a WSF vendor to provide an Example Test Procedure to the Contractor for modification does not relieve the Contractor of the responsibility for performing the test or demonstration. In such a case where the necessity for such a test or demonstration is clearly defined elsewhere in the Technical Specification, or by the Authoritative Agencies, the Contractor shall prepare an approved test procedure. The test procedure shall follow the same format and embody the same content, including data sheets with expected and actual results, as the WSF available Example Test Procedures. The Contractor shall follow the same requirements as stated in the *WSF Example Test*

1       *Procedures* Subsection in this Section of the Technical Specification for referenced  
2       guidance, referenced conformance, submittal, review, approval and revision.

### 3       **101.4.3       Test Procedure Completion**

4       Upon the satisfactory conclusion of a test, the Contractor shall submit the “original” of  
5       the completed Test Procedure to the WSF Representative with the acceptance signatures  
6       of the cognizant Authoritative Agencies and the Contractor within fourteen (14) days of  
7       test completion. The WSF Representative shall show final acceptance by WSF by  
8       signing the WSF acceptance block and returning the original to the Contractor.

9       The Contractor shall then provide the WSF Representative with the original plus two (2)  
10      legible copies, and make available to the cognizant Authoritative Agency one (1) legible  
11      copy of each test procedure with all final acceptance signatures no less than five (5) days  
12      after receipt from the WSF Representative.

### 13      **101.5 TEST NOTIFICATION AND COMPLETION**

14      The Contractor shall provide a standard form to be used for the purpose of notifying the WSF  
15      Representative of an up-coming test and the status of that test upon completion. The form  
16      shall include space for all entries as illustrated on **FIGURE 101-1** below. At the  
17      Contractor’s option, **FIGURE 101-1** may be used.

**FIGURE 101-1**  
**Test/Inspection Notification Form**

|  |  |   |   |
|--|--|---|---|
| <b>VESSEL NAME</b>                               | <b>TEST/INSPECTION START<br/>DATE AND TIME</b> | <b>MEETING PLACE</b>  |   |
| <b>SPECIFICATION #</b>                           | <b>TEST PROCEDURE #</b>                        | <b>PRELIMINARY<br/>TEST/INSPECTION<br/>Performed by<br/>(Include Date &amp; Time)</b> | <b>Contractor QA Test<br/>Readiness Certification</b> |
|  |  |   |   |
|  |  |   |   |
| <b>CONTRACTOR'S REPRESENTATIVE NOTIFYING WSF</b> |  | <b>WSF REPRESENTATIVE NOTIFIED<br/>(Include Date &amp; Time)</b>                      |   |

## TEST/INSPECTION COMPLETION

| TEST/INSPECTION RESULTS ( Circle One )                             |        |   |                           |
|--|--------|---|---------------------------|
| SATISFACTORY   |        | UNSATISFACTORY  |                           |
| COMMENTS :   |        |   |                           |
|  |        |   |                           |
|  |        |   |                           |
|  |        |   |                           |
|  |        |   |                           |
|  |        |   |                           |
| TEST/INSPECTION OBSERVERS  |        |   |                           |
| ORGANIZATION   | NAME:  | DATE:   | TIME:                     |
| CONTRACTOR   |        |   |                           |
| WSF  |        |   |                           |
| USCG   |        |   |                           |
| ABS  |        |   |                           |
| OTHER  |        |   |                           |
| TEST EQUIPMENT USED  |        |   |                           |
| MAKE:  | MODEL: | SERIAL NUMBER:  | DATE CALIBRATION EXPIRES: |
|  |        |   |                           |
|  |        |   |                           |
|  |        |   |                           |
| IF PARTIAL SYSTEM TEST/INSPECTION, PERCENT OF SYSTEM NOW COMPLETE: |        | IF PARTIAL OF TEST PROCEDURE, PERCENT OF TEST PROCEDURE NOW COMPLETE: |                           |
|  |        |   |                           |



The Contractor shall provide the WSF Representative with one (1) copy of the completed notification portion of the form no less than twenty-four (24) hours prior to the test or inspection. The Contractor shall then provide the WSF Representative with one (1) copy of the filled out completion portion of the form immediately after the conclusion of the test.

At the time a Test Procedure is submitted to the WSF Representative for final acceptance, there shall be attached to that Test Procedure a copy of each test notification and completion form associated with that Test Procedure.

The Contractor shall also be responsible for notifying any cognizant Authoritative Agency when their attendance is required and shall schedule tests to coincide with cognizant Authoritative Agency availability.

## 101.6 TEST CONDUCT

Prior to notifying the WSF Representative of a test, the Contractor's quality assurance organization *shall have previously inspected, pre-tested, and approved the system, equipment, machinery, or component* for scheduling of testing. The test notification shall include a statement that the Contractor has *previously inspected, pre-tested, and approved the system, equipment, machinery, or component*

WSF will not recognize any test or demonstration performed without a Test Procedure, that has been approved for use by the WSF Representative. The Contractor shall have on-site during the test or demonstration the original copy of the test procedure. Where tests or demonstrations are performed incrementally over time, the Contractor shall continue to have the original copy of the test procedure for the recording of data. The Contractor shall make additional data sheet copies, as required.

All set-points shall be verified by the actual or simulated condition which actuates the alarm, switch, valve or component, however in no case will the safety of the system, equipment, machine, or component be jeopardized or caused to operate outside of its designed parameters. The mis-setting of set-points or manual closing of switch contacts **shall not be an acceptable method** of set-point verification.

All instrumentation, whether permanently installed or portable, Contractor or WSF furnished, shall be calibrated **prior** to being used to collect test data. All instrumentation shall bear a current calibration sticker indicating the calibration expiration date and the calibrating facility. When requested by the WSF Representative, the Contractor shall prove calibration traceability to an accepted national standard. Should any test data appear to be erroneous, the instrumentation providing such data shall be recalibrated and the test repeated.

The Contractor shall also provide any supports, piping, or wiring that may be required for special purpose temporary instrumentation.

## 101.7 TEST SCHEDULE

The Contractor shall prepare a detailed schedule of all tests. The Test Schedule shall show the test start date and its duration. The Contractor shall provide three (3) copies of this Test Schedule to the WSF Representative at least thirty (30) days prior to the start date of the first test. The Contractor shall review and update this schedule monthly and resubmit to the WSF Representative for review.

The Contractor shall submit an updated Test Schedule together with the monthly Progress Billing. Progress payments **will not** be made until all of the required Test Schedule(s) have been received by the WSF Representative. The updated Test Schedule(s) shall reflect changes in the times and dates of the tests and/or delays which may have been encountered in the performance of the tests. A written analysis of the cause for any and all delays encountered shall be submitted with the updated Test Schedule.

## 101.8 TEST EQUIPMENT AND INSTRUMENTS

Use the Vessel's installed instruments for test data where possible. Provide additional, or special instrumentation where needed for any tests, including temporary supports, piping, and wiring. Calibrate all instruments used in each test, prior to the test. This includes both the Propulsion System instruments and temporary test instruments. Attach a label on each system gage, thermometer, and other indicator, indicating date of calibration and by whom the calibration was performed. If any test data appears to be erratic or inconsistent, recalibrate the instruments involved and repeat the test.

**NOTE:** Any instrument which has been "factory calibrated" prior to shipping to the Shipyard **will not** be considered to meet the calibration requirements of this Work Item, and shall require recalibration by the Contractor after installation on the Vessel at the Contractor's sole expense.

Prior to operational testing, the Contractor shall set all machinery plant and auxiliary alarms affected by the Work to design values. The actual set point for each alarm shall be recorded. The Contractor shall also provide, for each Vessel, any test kits or rigs, such as RTD or thermocouple simulators, or rigs to bleed off lube oil for shutdowns, to demonstrate the satisfactory operation of alarms for same. Simulators shall inject signals as close to the sensors as possible, not downstream of the transmission units. The ability to quickly access RTD or thermocouple sensors without the necessity of cutting the cables shall be incorporated.

## 101.9 EQUIPMENT OPERATING LOGS

The Contractor shall provide an Equipment Operating Log for each individual piece of equipment. The operating log shall be used to record the date the equipment was operated, the total time it was operated, any failures or abnormal conditions during operation, and the

individual responsible for its operation. These operating logs shall be available to the WSF Representative upon request. All Equipment Operating Logs shall be delivered to the WSF Representative upon Vessel delivery.

## **101.10 HULL TESTS**

### **101.10.1 Bulkheads, Decks and Windows**

Prior to painting, but after all welding is complete; test watertight, fume-tight, and weather-tight bulkheads, decks, overheads, and all exterior windows, by directing a solid stream of fresh water, at a pressure of not less than 30 psig from a 1½ inch nozzle, against the exterior surfaces of all seams and butts of plating, and against all penetrations and windows. The stream shall be applied at a distance of 10 to 15 feet from the surface being tested and zero leakage shall be the standard.

Interior bulkheads may be tested by means of a compressed air and soap solution test in lieu of the directed water stream test. Compressed air shall be no less than 75 psig utilizing a hose of no less than ¾ inch diameter with a nozzle of no less than ⅜ inch diameter directed perpendicular to, and no more than six (6) inches away from, the joint being tested. The soap solution, similar to McMASTER-CARR liquid leak detector #10875T12, or equal, shall be applied to the far side of the joint being tested in such quantity and concentration as to ensure indication of any compressed air passing through the joint being tested.

Liquid leak detector solutions shall be limited to current commercial detection solutions. The use of soap buds or household detergents and water **will not** be considered a satisfactory leak-test fluid for a bubble testing, because of the lack of sensitivity due to masking by foam, as set forth in ASTM E515.

If approved for use by the USCG, the Contractor may utilize a vacuum box technique method for leak detection as set forth in ASTM E515 for flat, accessible weld seams.

Repair all indicated leaks and retest as outlined above.

### **101.10.2 Sliding Watertight Door**

With no electric power, and using each available power source, demonstrate compliance with 46 CFR§112.55-15, ASTM F1196, and ASTM F1197.

Operate each sliding watertight door from each door control station, both electrically and manually.

Check the door sealing surfaces by inspection using Dykem, or some other suitable indicator, and adjust until 100-percent (100%) contact is obtained.

**101.10.3 Watertight Doors (non-sliding) and Hatches**

Conduct a chalk test of each watertight door and hatch to show 100-percent (100%) contact of the door or hatch seal against the frame when normally closed.

Adjust as required to obtain the required 100-percent (100%) contact.

**101.10.4 Weathertight, Acoustically Treated and Fire Doors**

Conduct a chalk test on each weathertight and acoustically treated door to show 100-percent (100%) contact of the door against the frame seal when latched normally.

Adjust as required to obtain the required 100-percent (100%) contact.

On all other doors, check and note the fit in the frames when closed and latched normally.

Ensure that the doors open and close easily and that closure is complete to the latch setting without assistance.

Demonstrate that all door closures will close their door properly with the Vessel listed 3½ degrees away from the door's closing direction.

**101.10.5 Vehicle Deck Curbs**

Using a calibrated test gage with ¼ pound subdivisions, apply a two (2) psig air test to Vehicle Deck curbing. Monitor the air pressure for five (5) minutes.

A drop in air pressure of more than ⅛ pound during the five (5) minute test will require repair and retest.

**101.10.6 Lifting Devices, Including Padeyes, Trolley Beams, and Boat Davits**

Unless directed differently in a specific Section of the Technical Specification, statically load test each installed lifting device to 1½ times its rated capacity. In those instances where lifting devices may be subjected to dynamic loading, test the lifting devices to 1½ times their rated capacity for both static and dynamic loading.

Provide a written report of each test to the WSF.

Provide permanently installed engraved metal labels at each tested item that indicates tested, rated load, test load applied, date tested, and identity of the testing facility or

individual. Lettering shall be no less than  $\frac{1}{4}$  inch in height. Metal labels shall meet the requirements of Section 24 of the Technical Specification.

### **101.10.7 Cableway MCT, MCP, and Stuffing Tube Testing**

Wireway deck and bulkhead transits, and stuffing tubes through the Main Deck and below; and those to the weather, shall be block-to-housing, block-to-block, and block-to-cable tested by means of a compressed air and soap solution test. Compressed air shall be no less than 35 psig utilizing a hose of no less than  $\frac{3}{4}$  inch diameter with a nozzle of no less than  $\frac{3}{8}$  inch diameter directed perpendicular to, and no more than eight (8) inches away from, the transit blocks being tested. A soap solution, similar to NUPRO "SNOOP" liquid leak detector (or current equivalent) shall be applied to the far side of the transit being tested in such quantity and concentration as to ensure indication of any compressed air passing through the blocks being tested.

Liquid leak detector solutions shall be limited to current commercial detection solutions. The use of soap buds or household detergents and water **shall not** be considered a satisfactory leak-test fluid for a bubble testing, because of the lack of sensitivity due to masking by foam, as set forth in ASTM E515.

Transits shall be 100-percent (100%) tested. Zero leakage shall be the acceptable standard.

Repair all indicated leaks, and retest as outlined above.

### **101.11 DYE PENETRATION TESTING**

All Dye penetrate testing shall be performed by Certified Testing Personnel under the requirements of ANSI/ASNT CP-189.

All Dye penetrate testing shall be in accordance with the requirements of ASTM E165, ASTM E1208, ASTM E1209, ASTM E1219, ASTM E1316, and ASTM E1417 as applicable to the method utilized. The application of a dye penetrate to one side of a weld, and applying the developer to the other side of that weld **will not be an acceptable testing method**.

Remove all NDT dyes and developers completely after inspection by USCG and/or WSF Inspectors, and before painting preparation.

## 101.12 STATIC PRESSURE TESTS

### 101.12.1 Hull and Independent Tanks

Prior to painting, static pressure test all non-pressure Vessel tanks in accordance with Authoritative Agencies' requirements.

Following the test and any repairs or retests, thoroughly clean and dry the tanks prior to preservation or painting as set forth in Section 14 of the Technical Specification. See **TABLE 101-1** below for tank test pressures and medium requirements. Any system not listed below shall be tested as agreed between the Shipyard and the WSF Representative to meet Authoritative Agency and manufacturer's requirements.

### 101.12.2 Piping Systems

All piping systems shall be cleaned and flushed (see Section 74 of the Technical Specification), without insulation at any joint or valve. All pipe threads and gasketed or welded joints shall be free of paint when tested.

All components and equipment, including the hot water heaters, which are normally subject to the pressure of the system shall be tested with the system.

After cleaning and flushing, hydrostatically test all piping systems (except Hi-Fog mist fire suppression systems), components, appurtenances, and integral equipment and components as required by 46 CFR §56.97. Apply pressure to each system in its entirety unless otherwise specified. See **TABLE 101-1** below for system test pressures and medium requirements. Any system not listed below shall be tested as agreed between the Shipyard and the WSF Representative to meet Authoritative Agency and manufacturer's requirements.

Hydrostatically test sanitary, interior, and weather deck drains to the level of the highest fixture.

The hydrostatic or pneumatic pressure required for the piping systems shall be held for no less than 10 minutes and for any additional time as may be required to thoroughly inspect the entire completed system for leaks. There shall be **zero** leakage; **zero** weeps, and **no** permanent deformation in any piping system component for a test to be acceptable.

The Hi-Fog mist fire suppression system piping shall be tested to meet USCG and manufacturer's requirements using the required media and test pressures.

- 1 After testing air and oil systems, drain and thoroughly dry out the entire system with
- 2 clean dry air, or dry nitrogen until no signs of moisture appear on a piece of filter paper
- 3 held directly in the air or nitrogen stream.
- 4 Record the test, including the pressure attained and the period of time that the pressure
- 5 was held, of each system on the appropriate test procedure form.
- 6 Repair any leaks or deformations and retest to prove the system tight.
- 7 After all tests and trials, and before the Vessel is delivered, clean all strainers, renew all
- 8 filter elements and provide new and unused fluids in all hydraulic and lubricating oil
- 9 systems. Tag each cleaned or changed unit with the date it was cleaned, or a new filter
- 10 element and/or fluid was installed.

| <b>TABLE 101-1</b><br><b>Piping System Test Pressures and Test Media</b> |  |  |
|--|--|--|
| <b>PIPING SYSTEM</b>   | <b>TEST MEDIA</b>                                      | <b>TEST PRESSURE</b>                                   |
| SOIL & PLUMBING DRAINS   | Water  | Fill to Top of Fixture or Vent                         |
| INTERIOR DECK DRAINS   | Water  | Fill to Top of Fixture or Vent                         |
| WEATHER DECK DRAINS  | Water  | Fill to Top of Fixture or Vent                         |
| BILGE SYSTEM   | Water  | 1.5 Times the Maximum Allowable Working Pressure       |
| CO <sub>2</sub> SYSTEMS  | CO <sub>2</sub> or other Inert Gas                     | As required by Authoritative Agencies                  |
| HI-FOG FIRE SUPPRESSION SYSTEM   | As required by Authoritative Agencies and Manufacturer | As required by Authoritative Agencies and Manufacturer |
| HYDRAULIC SYSTEMS  | Service Fluid  | 1.5 Times the Maximum Allowable Working Pressure       |
| FUEL OIL SYSTEMS   | Water or Service Fluid                                 | 1.5 Times the Maximum Allowable Working Pressure       |
| LUBE OIL SYSTEMS   | Water or Service Fluid                                 | 1.5 Times the Maximum Allowable Working Pressure       |
| WASTE OIL SYSTEMS  | Water  | 1.5 Times the Maximum Allowable Working Pressure       |
| SEAWATER COOLING SYSTEMS   | Water  | 1.5 Times the Maximum Allowable Working Pressure       |
| FIREMAIN AND SPRINKLING SYSTEMS  | Water  | 1.5 Times the Maximum Allowable Working Pressure       |

| <b>TABLE 101-1, cont'd</b><br><b>Piping System Test Pressures and Test Media</b> |                                    |  |
|--|------------------------------------|--|
| <b>PIPING SYSTEM</b>   | <b>TEST MEDIA</b>                  | <b>TEST PRESSURE</b>                                   |
| WATER SYSTEMS  | Water                              | 1.5 Times the Maximum Allowable Working Pressure       |
| FRESH WATER FLUSHING AND COOLING SYSTEMS   | Water                              | 1.5 Times the Maximum Allowable Working Pressure       |
| DIESEL ENGINE EXHAUST SYSTEMS  | Air                                | 1 Psig   |
| STEAM SYSTEMS  | Water                              | 1.5 Times the Maximum Allowable Working Pressure       |
| CONDENSATE SYSTEMS   | Water                              | 1.5 Times the Maximum Allowable Working Pressure       |
| REFRIGERATION SYSTEMS  | Nitrogen or CO <sub>2</sub>        | 1.5 Times the Maximum Allowable Working Pressure       |
| COMPRESSED AIR SYSTEMS   | Nitrogen or Dry Air                | 1.2 - 1.25 times Maximum Allowable Working Pressure    |
| CONTROL AIR SYSTEMS  | Nitrogen or Dry Air                | As required by Authoritative Agencies and Manufacturer |
| WASTE OIL STORAGE  | 11.5 Feet Head                     | Water  |
| FUEL OIL DAY   | Head to Top of Tank Vent or 2 Psig | Water or Air   |
| POTABLE WATER STORAGE  | Head to Top of Tank Vent or 2 Psig | Water or Air   |
| JACKET WATER HOLDING   | Head to Top of Tank Vent or 2 Psig | Water or Air   |
| JACKET WATER FILL  | Head to Top of Tank Vent or 2 Psig | Water or Air   |
| LUBE OIL STORAGE   | Head to Top of Tank Vent or 2 Psig | Water or Air   |
| HYDRAULIC OIL STORAGE  | Head to Top of Tank Vent or 2 Psig | Water or Air   |



| <b>TABLE 101-1, cont'd</b><br><b>Piping System Test Pressures and Test Media</b> |                                       |                      |
|--|---------------------------------------|----------------------|
| <b>PIPING SYSTEM</b>   | <b>TEST MEDIA</b>                     | <b>TEST PRESSURE</b> |
| FUEL OIL STORAGE   | 11.5' Head                            | Water                |
| SEWAGE HOLDING   | Head to Top of Tank Vent or 2<br>Psig | Water or Air         |

### 101.13 AUXILIARY SYSTEMS OPERATIONAL TESTS

Test all auxiliary systems to show conformance with design and performance requirements of the individual Sections of the Technical Specification.

Fully demonstrate the operation of all installed machinery, equipment, components, controls and instrumentation as required by approved test procedures.

Failure of the Technical Specification to enumerate, in detail, all of the operational tests that may be required to fulfill the intent of the Technical Specification does not relieve the Contractor of its responsibility to prove the integrity, functionality, and operational performance of each installed equipment, component, or system, whether Contractor furnished or OFE (WSF furnished).

Operational tests shall include demonstrations of, but are not limited to, the following:

#### 101.13.1 Heating, Ventilation and Air Conditioning

1. Air tightness and balance of each system so that the delivered quantity of air to each compartment is plus or minus 5-percent ( $\pm 5\%$ ), and to each terminal, diffuser, etc., is plus or minus 10-percent ( $\pm 10\%$ ), of design value. For systems with two-speed fans, conduct the balance at high speed. For compartments served by more than one fan, verify balance with all fans operating at high speed. Demonstrate satisfactory air tightness and balance of each system prior to the concealment of ductwork, and with scaffolding available. All supportive services shall be pulled back from all compartment accesses and openings served by the air handler system being balanced.

2. Air handlers, supply fans, exhaust fans, and re-circulation fans, including automatic and remote manual start, stop and speed change from HVAC Control System (HCS).
3. Air Conditioning systems, including individual room temperature control. For cooling coils, record air flow in cubic feet per minute (CFM), air pressure loss in inches of water, air temperature change in Fahrenheit (F) degrees at each fan speed with a maximum demand signal to the air conditioning refrigeration unit.
4. Air handler hot water heating coils and duct heater hot water coils and modulating hot water control valves. Record air flow in cubic feet per minute (CFM), air pressure loss in inches of water, air temperature change in Fahrenheit degrees and heating water temperature change in Fahrenheit degrees at each fan speed with the heating water control valve full open.
5. Unit heaters and convection heaters including automatic “on” and “off” features.
6. Operation of the HVAC System Master Controller, including automatic changeover from cooling to heating, starting/securing of air handlers, fans and refrigeration units, hot water control devices, and remotely operated dampers.
7. Operation of the HVAC System Controller in the Engineer’s Operating Station, including logging, display, control, alarm and monitoring functions.
8. Control thermostat operation.
9. Testing of the HVAC system shall conform to this Subsection and the *CONTROL SYSTEM* Subsection in Section 12 of the Technical Specification.
10. HVAC only noise measurement, shall be accomplished in accordance with ISO Standard 2923.

#### **101.13.2 Fire Protection**

1. Manual and automatic fire dampers, weather closures, and EOS area window closures.
2. Fire Extinguishing media operated fire dampers, fan shutdowns, and alarms.
3. Hi-Fog High Pressure Water Mist Fire Suppression System.

- 1        4.    Hi-Fog Local Application High Pressure Water Mist Fire Suppression System.
- 2        5.    Emergency Generator Room Hi-Fog High Pressure Water Mist Fire Suppression
- 3                System.
- 4        6.    UVD Paint Locker Hi-Fog High Pressure Water Mist Fire Suppression System.
- 5        7.    Vehicle Deck Manual Sprinkler System.
- 6        8.    Local and remote Fire Extinguishing media control stations, and that Fire
- 7                Extinguishing media will actually discharge from distribution nozzles.
- 8                **NOTE:** Items 3, 4, 5, and 6 above shall require a system discharge to
- 9                        demonstrate that the system is capable of discharging to each Engine
- 10                        Room (total flood and local application), Emergency Generator Room,
- 11                        and the Paint Locker in the event of emergency actuation.
- 12        9.    Check off portable fire fighting and rescue equipment.
- 13        10.   Check off Fire Extinguishing media bottle weight records.

### 101.13.3        Life Saving Equipment

- 15        1.    Rescue Boat Davits under power and manual operation loaded as required by
- 16                46 CFR §75.35.
- 17        2.    Rescue Boat launching, retrieving and stowing, loaded as required by
- 18                46 CFR §75.35.
- 19        3.    Rescue Boats, their motors and all boat systems.
- 20        4.    Check-off all life saving equipment.
- 21        5.    Trip each Vehicle Deck life jacket bin two (2) times while it is loaded equivalent to
- 22                its capacity in life jackets, and one (1) time fully loaded with life jackets.
- 23        6.    Inspection of each High Slide Marine Evacuation Systems (MES) and Link life raft
- 24                Apparatus release mechanism.

1    **101.13.4       Safety Lines and Equipment**

- 2       1.    Demonstrate all safety line system equipment, installations, equipment, access, and  
3           hook-up to assure proper, safe, and unhindered operation.

4    **101.13.5       Food Preparation/Vending Areas**

- 5       Demonstrate all food preparation/vending areas equipment and services to assure proper  
6       operation.

7    **101.13.6       Plumbing Fixtures**

- 8       1.    Flush valves, automatic, manual and timer valve operation.
- 9       2.    Lavatory (including auto-sensing feature), shower and sink faucets and drains  
10       operation.
- 11      3.    Hot and cold water mixing valves.
- 12      4.    Soap dispensing systems.
- 13      5.    Hand dryers.

14   **101.13.7       Fuel Oil**

- 15      1.    Transfer Pump.
- 16      2.    Fuel Oil Purifier.
- 17      3.    Fill from the Vehicle Deck station to each storage tank.
- 18      4.    Transfer from each storage tank to the day tank and to deck discharge.
- 19      5.    Purify from each storage tank to the day tank.
- 20      6.    Transfer from the day tank to Emergency Diesel Generator Day Tank.
- 21      7.    Purify from the day tank back to the day tank.

- 1        8.    Purify from each storage tank back to the respective storage tank.

2    **101.13.8        Lubricating Oil**

- 3        1.    Main Engine lube oil gravity fill and controls.

- 4        2.    Ship's Service Diesel Generator Sets lube oil gravity fill and controls.

- 5        3.    Used oil transfer pump and controls.

- 6        4.    Main Engine pre-lube pumps and controls.

- 7        5.    Main Engine turbocharger priming and soak-back pump and controls.

- 8        6.    Transfer from storage to Main Engines by gravity fill. Record the time to transfer  
9        twenty (20) gallons to each unit.

- 10       7.    Transfer from Ship's Service Diesel Generator lube oil storage tank to each Ship's  
11       Service Diesel Generator utilizing Ship's Service Diesel Generator by gravity fill.  
12       Record the time to transfer ten (10) gallons.

- 13       8.    Gravity transfer from each Main Engine and Ship's Service Diesel Generator to the  
14       Used Oil Tank.

- 15       9.    Transfer from the Oily Bilge Water Tank, the stern tube oil drain tanks, the purifier  
16       drip tank and the No. 1 bilge manifold to the Used Oil Tank and to the used oil deck  
17       connection.

- 18       10.   Transfer from the used oil tank to the deck connection using the Used Oil Transfer  
19       Pump.

- 20       11.   Transfer from the oily bilge water tank, the purifier drip tank, the No. 1 bilge  
21       manifold, and the used oil tank through the used oil deck connection to a used oil  
22       truck.

23    **101.13.9        Stern Tube Lubricating Oil System**

- 24       1.    Circulate lubricating oil to Stern Tube bearings and check seals for leakage.

- 25       2.    Stern Tube Lube Oil Pumps, controls and alarms.

**1 101.13.10 Oil-Water Separator System**

- 2 1. Wet the pump suction and discharge chambers prior to startup to prevent the pump  
3 running in a dry condition.
- 4 2. Fill the oily water suction line prior to startup to ensure air bubbles do not cause false  
5 reading at the oil content monitor.
- 6 3. Verify the clean water supply pressure is regulated to 20 PSI.
- 7 4. Verify the clean water flow rate is adjusted to one (1) GPM.
- 8 5. Verify the clean water temperature is between 100F – 150F degrees.
- 9 6. Verify the power to the unit is turned on and the “POWER ON” indicator light is  
10 illuminated.
- 11 7. Place the control switch in the “FLUSH” position and verify clean water flow in the  
12 re-circulating line to the Oily Bilge Water Tank.
- 13 8. Add one hundred (100) gallons of clean freshwater and five (5) gallons of lubricating  
14 oil to the No. 1 Used Oil Tank.
- 15 9. Place the control switch in the “RUN” position.
- 16 10. Verify the unit fills with clean water, the suction pump starts, and non-oil containing  
17 water emerges from the water discharge outlet.
- 18 11. Verify the “WATER DISCHARGE” indicator light is illuminated.
- 19 12. Verify the Oil Content Monitor reads between 0 – 100 PPM.
- 20 13. Pump the No. 2 Oily Bilge Water Tank down to where the suction line picks up oil.
- 21 14. Verify the unit begins a re-circulating mode and the “OIL DISCHARGE” indicator  
22 light illuminates.
- 23 15. Back flush the unit for thirty (30) minutes before securing from the test.

**101.13.11 Seawater Systems**

1. Fire and Sprinkling systems: demonstrate that each pump provides 50 psi pitot tube pressure simultaneously through the hose nozzles of the most remote fire stations on the opposite End of the Vessel in accordance with Authoritative Agency requirements. Unless specifically required differently in other Sections of the Technical Specification, demonstrate that each combination of two (2) pumps will simultaneously supply 50 psi pitot tube pressure through hose nozzles of the most remote fire stations and 15 psi pitot tube pressure at each nozzle of the two (2) largest sprinkler zones in accordance with Authoritative Agency requirements.
2. Bilge pumping systems: with each bilge pump, demonstrate suction, to the satisfaction of the USCG, from all accessible spaces to the oily bilge collecting tank and to the oily bilge water deck connection.

**101.13.12 Fresh and Potable Water Systems**

1. Freshwater pumps and controls.
2. Hot water re-circulation pumps and controls.
3. Potable water heaters and heater controls including thermostatic control valves.
4. Flushing water pumps, pressure tanks and controls.
5. Jacket Water Circulating Pump and engine cooling; test with engines.
6. Main Engine lay-up heater re-circulation pump, heat exchanger and temperature controls.
7. Machinery fresh water cooling pumps and controls.

**101.13.13 Oil-fired Hot Water Heater**

1. Heater, including automatic and safety controls.
2. Heater safety valve.
3. Heater circulating pumps and alarms.

**101.13.14 Sewage Holding and Transfer Systems**

1. Holding tank aeration blowers and associated relief valves.
2. Holding tank fume exhaust blowers.
3. Holding tank transfer pumps, level controls and alarms.
4. Lift station pumps, level controls, and alarms.
5. Transfer to shore connections.
6. Transfer from tank to tank.
7. Fresh water back-flush system: Including the tank cleaning nozzles, sewage transfer hose flushing, transfer pump gland sealing and transfer pump priming/clean out.

**101.13.15 Tank Level Indicators****101.13.15.1 Calibration**

Capacity indication and repeatability, including verification of accuracy of sounding tables.

**101.13.16 Compressed Air Systems**

1. Main Engine pneumatic start controls.
2. Time to charge storage tanks.
3. Combined total of cold starts of the Main Engines, (for each engine) to meet the requirements of the Authoritative Agencies.
4. Ship's Service Diesel Generator Sets start (each).
5. Vessel's whistles. All blasts that may be required by the Rules of the Road without loss of audible volume during the blast.
6. UV/IR Electro-Optical Fire Detector System fire detector air shield system.



- 1        7.    Ship Service air system at all outlets.

2    **101.13.17      Elevators**

- 3        1.    Operate each elevator at all levels and test all controls and safety.
- 4        2.    Demonstrate that no binding or rough running occurs.

5    **101.13.18      Steering Gears and Anchor Winch**

- 6        1.    Operate each Steering Gear from all stations, with each pump, demonstrating all  
7            controls, transfers, indicators (including accuracy and repeatability), alarms, and  
8            safety features.
- 9        2.    Demonstrate the ability of the manual anchor winch to hoist rated load.
- 10       3.    Demonstrate manual anchor winch ratcheting pawl ability to hold rated load.
- 11       4.    Demonstrate manual anchor winch drum brake ability when lowering rated load, to  
12           control payout speed and to stop.

13   **101.13.19      Workshop Equipment and Trolley**

- 14       1.    Demonstrate all Workshop equipment.
- 15       2.    Move each trolley along the trolley rails, demonstrate clearance for handling a Main  
16           Engine turbocharger and Ship's Service Diesel Generator engine along entire track.
- 17       3.    Demonstrate trolley dynamic lift of rated working load in accordance with  
18           manufacturer's specifications. See the *LIFTING DEVICES, INCLUDING PADEYES,*  
19           *TROLLEY BEAMS, AND BOAT DAVITS* Subsection in this Section of the Technical  
20           Specification for additional requirements.

21   **101.14 SHIP'S SERVICE AND EMERGENCY DIESEL GENERATOR SETS**

22   **101.14.1       Diesel Engine Tests**

- 23       The Contractor shall provide the services of a factory authorized service engineer to carry  
24       out the initial start-up and testing of the three (3) Ship's Service Diesel Generator Sets  
25       and the Emergency Diesel Generator Set. Each diesel-alternator shall be test-run for a

sufficient period of time to meet the factory authorized service engineer's requirements. Testing of the diesel-alternator sets shall demonstrate, at a minimum, the following:

1. Satisfactory operation of the unit with the alternator at its rated RPM and 100-percent (100%) of rated load for four (4) hours, followed by 110-percent (110%) rated load for two (2) hours.
2. Proper operation of the start and stop controls both at the unit and at the remote stations.
3. Proper operation of speed control both at the unit and at the remote stations.
4. Normal operation of all meters, gages, and alarms.
5. Proper temperatures and pressure are maintained during the load test.
6. Proper functioning of all safety, shutdown, and auto-start devices.

#### **101.14.2 Diesel Generator Set Tests**

The Contractor shall conduct tests required by the Authoritative Agencies. In addition, the following tests shall be conducted:

1. Insulation Resistance Test between all phases and each phase to ground. Insulation resistance readings shall be taken at the power breaker in the Emergency Switchboard.
2. Run all generator sets until a constant temperature is reached and for a minimum of four (4) hours at full load. Temperatures shall not exceed those recommended by Table A3 of Reference (101C).
3. Test the operation and capacities of the start-up systems by bringing all alternators on-line and off-line manually a minimum of six (6) times, and by initiating the automatic start up and on-line operation and tripping of the Emergency Diesel Generator Set a minimum of six (6) times in accordance with 46CFR §112.50-5.
4. Test all engine alarms, monitoring devices, and failure shutdowns.
5. Verify operation of the alternator resistance heaters and the Jacket Water Heaters. Verify that heaters de-energize upon start up of the Emergency Diesel Generator Set engine.

### 101.14.3 SSDG Removal Demonstration

After completion and weight testing of the Engine Room trolley systems installed in accordance with the requirements of Sections 50 and 80 of the Technical Specification, the Contractor shall provide demonstration of the rigging and removal of an equivalence of a SSDG prime mover from each Engine Room using the installed trolley system. The test weight (module) shall duplicate the weight and perimeter dimensions of a prime mover in a real world scenario. The demonstration shall remove the test module from each SSDG location to the Lower Vehicle Deck. One (1) module, as directed by the WSF Representative shall then be returned to it's Engine Room location from the Lower Vehicle Deck. See the *LIFTING GEAR* Subsection in Section 50 of the Technical Specification.

## 101.15 MAIN PROPULSION DIESELS

### 101.15.1 Main Diesel Engine Tests

The services of the Propulsion System Integration (PSI) Contractor's technical representative(s) shall be provided by the WSF Representative as described in Section 51 of the Technical Specification. The Contractor shall provide required support to these technical representative(s) to enable him to ascertain that the Main Engines are properly installed, aligned, and ready to operate.

**S Main Engines shall not be started or turned over with starting air without the prior approval of the PSI Contractor's technical representative, the Main Diesel Engine Sub-contractor's technical representative, and the WSF Representative.**

Initial start-up and no-load testing of the Main Engines shall be accomplished by the Contractor under the supervision of the PSI Contractor's technical representative(s). No-load testing shall demonstrate, at a minimum, the following:

1. Proper operation of start and stop controls both at the unit and at the remote stations.
2. Proper function of the governor speed control system (both at the unit and at the remote stations).
3. Normal operation of all meters, gages, and alarms.
4. Proper temperatures and pressures maintained during the tests.

5. Proper functioning of all safety and shutdown devices.
6. Proper operation of all engine attached accessories.
7. Proper functioning of pre-lube and post-lube.
8. Test the operation and capacities of the start-up systems by bringing the Main Engines on-line and off-line manually a minimum times as set forth by the Authoritative Agencies. Set Section 72 of the Technical Specification.

#### **101.15.2 Main Propulsion Reduction Gears**

The services of the PSI Contractor's technical representative(s) shall be provided by the WSF Representative as described in Section 52 of the Technical Specification. The Contractor shall provide required support to these technical representative(s) to enable him to ascertain that the Reduction Gears are properly installed, aligned, and ready to operate.

**S Reduction Gears shall not be turned over without the prior approval of the PSI Contractor's technical representative(s), the Reduction Gear Sub-contractor's technical representative, and the WSF Representative.**

Testing of the Reduction Gears shall be accomplished by the Contractor under the supervision of the PSI Contractor's technical representative. Testing shall demonstrate, at a minimum, the following:

1. Proper operation of controls both at the unit and at the remote stations.
2. Normal operation of all meters, gages, and alarms.
3. Proper temperatures and pressures maintained during the tests.
4. Proper functioning of all safety and shutdown devices.
5. Proper operation of all Reduction Gear attached accessories.
6. Proper functioning of lube oil and cooling systems.
7. Noise levels as set forth in Section 102 of the Technical Specification.

### 101.15.3 Main Engine Turbocharger Removal Demonstration

After completion and weight testing of the Engine Room trolley systems installed in accordance with the requirements of Sections 50 and 80 of the Technical Specification, the Contractor shall provide demonstration of the rigging and removal of an equivalence of a Main Engine turbocharger from each Engine Room using the installed trolley system. The test weight (module) shall duplicate the weight and perimeter dimensions of a turbocharger in a real world scenario. The demonstration shall remove a test module from an engine location in each Engine Room selected by the WSF Representative to the Lower Vehicle Deck. One (1) module, as directed by the WSF Representative shall then be returned to it's Engine Room location from the Lower Vehicle Deck. See the *LIFTING GEAR* Subsection in Section 50 of the Technical Specification.

### 101.16 ELECTRICAL SYSTEMS OPERATIONAL TESTS

Test all electrical systems to show conformance with design and performance requirements of the individual Sections of the Technical Specification.

Fully demonstrate the operation of all installed electrical machinery, equipment, components, controls, indicators, instruments, lighting, and communications systems.

Check each electrical device while under normal operational load and record observations. Check each switch indicator lamp and control device for its proper function.

Test each alarm system by simulating a malfunction of the circuits monitored by means of direct actuation of each sensor. ***No "destructive test" shall be performed.***

Prepare Test Memoranda covering installation and operational tests using the following Subsections as a guide.

Failure of the Technical Specification to enumerate in detail all of the operational tests that may be required to fulfill the intent of the Technical Specification does not relieve the Contractor of its responsibility to prove the integrity, functionality, and operational performance of each installed equipment, component, or system, whether Contractor furnished or OFE (WSF furnished).

Operational tests shall include demonstrations of, but are not limited to, the following:

#### 101.16.1 Cathodic Protection System

With a factory technician present, perform all tests prescribed by the manufacturer. Demonstrate proper operation of all components of the Cathodic Protection (impressed current) System. Demonstrate that power supply voltage levels and current are commensurate with hull, paint and marine conditions. Show proper response from reference cell and measure current to each cathode.

Demonstrate that Cathodic Protection System is not influenced by operation of other electrical equipment in the immediate vicinity, and that it does not influence the operation of other equipment in the vicinity.

#### **101.16.2 Cable Insulation Resistance**

Before the Ship's Service Power, AMA, and Propulsion Control System is scheduled for an operational test, insulation resistance measurements (meggering) shall be performed on each new or reused cable operating at more than 24 volts.

Unless directed different in specific Work Items of the Technical Specification, use a 500 volt "Megger" for circuits of 100 volts or greater and a 50 volt "Megger" for circuits of less than 100 volts. Measure the insulation resistance of each circuit between conductors and between each conductor and ground. Ungrounded neutral circuits, disconnect the neutral from ground for the tests. Minimum acceptable insulation resistance values shall be as defined in IEEE Standard 45-1998, Clause 8.13.3 for all existing cabling, and shall be 100 megohms minimum for all new cabling.

**NOTE:** Circuits containing appliances or solid state devices which have a voltage rating less than the test voltage shall have those items protected by physical disconnection at the appliance or device.

Lighting circuits which utilize fluorescent fixtures shall have the ballasts disconnected during the insulation resistance test.

The Contractor shall prepare an Insulation Resistance Test Report, which shall provide the following information:

- a. circuit identification
- b. measured resistance value (corrected to 25C degrees)
- c. date when circuit was checked
- d. name of person(s) performing test

Submit three(3) copies of all Insulation Resistance Test Reports to the WSF Representative prior to Vessel redelivery.

#### **101.16.3 Circuit Continuity Checks**

Circuit continuity checks shall be performed on all electrical circuits throughout the entire electrical installation affected by the Work, including but not limited to, power, lighting, interior communications, controls, alarms and electronic systems. This shall be

a prerequisite to any system being scheduled for an operational test. The Contractor shall prepare a Circuit Continuity Test Report which shall provide the following information:

- a. Circuit origin and destination
- b. Date that circuit was checked
- c. Name of person(s) performing the checks
- d. Agreement with drawings for new or modified existing equipment (i.e., cable numbers and wire identification floaters)

Three (3) copies of the Circuit Continuity Test Reports shall be submitted to the WSF Representative prior to Vessel redelivery.

#### **101.16.4 Motors and Controllers**

Test all motor-driven equipment under normal operating load conditions. Record hot and cold insulation resistance readings, operating volts, and amps for each motor. Check each operating pushbutton, selector switch, pilot light, remote pushbutton, pressure switch, and other control devices to assure proper operation. Check overload tripping devices for freedom of operation.

#### **101.16.5 Square D Powerlink® Lighting And Remote Control System**

Demonstrate the proper operation of all PowerLink® lighting, and other selected loads remote control system components under normal operating conditions. Check each operating hot-button at each monitor, auto/manual remote operation circuit breaker operation, indicator lights, local trips, power supplies, micro-processor-based controllers, and other control devices to assure proper operation of all controlled lights and equipment as set forth in Section 92 of the Technical Specification.

#### **101.16.6 Lighting**

1. ***At night***, turn on all lighting throughout the Vessel and observe the general lighting level in the various spaces. Demonstrate the Upper and Lower Vehicle Deck switching circuits. In the event lighting appears inadequate in particular locations, measure and record the lighting intensity at appropriate working levels in those locations.
2. ***At night***, turn off all normal lighting and note the intensity of the emergency lights to illuminate emergency escape routes and operation of vital machinery.

3. ***At night***, operate all floodlights including those for Rescue Boat operation and High Slide Marine Evacuation System (MES) Stations, and note intensity of lighting for these operations at both the launching area and the boarding area at water level. Demonstrate the landing lights and switches.
4. ***At night***, demonstrate proper operation of all searchlights, including remote operating stations, if applicable.
5. ***At night***, demonstrate proper operation of all navigation lights. Additionally demonstrate the navigation lights as required by Authoritative Agencies.

#### **101.16.7 Radio Equipment**

In conjunction with the WSF FCC radio technician, demonstrate proper operation of all radio systems at all locations and over the complete range of installed frequencies. Test for proper polarity of power supply voltage at each radio. Check that voltage stays within required limits when radio is transmitting. Perform a Voltage Standing Wave Ratio (VSWR) test on all radios. Test antenna signal field strength from outside the Pilothouses with portable field strength meter. Results shall be better than 1.5 to 1.0. Check that all radios continue to operate properly when other radios are keyed, including hand-held portable units. Test all cellular phone installations for satisfactory operation.

#### **101.16.8 Electronic Navigation Equipment**

With a factory technician present:

1. Demonstrate proper operation of all radars and radar repeaters and all combinations thereof.
2. Demonstrate proper operation of the gyro compass and all repeaters including interface with other navigation systems.
3. Demonstrate proper operation of the Satellite Compass System.
4. Demonstrate proper operation of the Global Positioning System (GPS).
5. Demonstrate proper operation of the Automatic Draft Indication System (ADIS™).
6. Demonstrate proper operation of the Universal Automatic Identification System (UAIS).



1           7. Demonstrate proper operation of the Wind Speed Indication System.

2   **101.16.9       Interior Communications Systems**

3       1. Demonstrate proper operation of all interior communications systems, including but  
4       not limited to, the following:

- 5           • Pilothouse Call System – CKT “A”
- 6           • Engineers Call System - CKT “B”
- 7           • Emergency Diesel Generator Set Control and Alarms – CKT “2EG”
- 8           • Fire Detection System - CKT “F”
- 9           • Fire Door Holding Magnets – CKT “FD”
- 10          • Fire Release and Shutdown System - CKT “FR”
- 11          • General Alarm System – CKT “G”
- 12          • Shipboard General Communications and Telephone System – CKT “J”
- 13          • Sound Powered Telephone System – CKT “1JV”
- 14          • Engineering Extension Jack System – CKT “X1JV”
- 15          • Elevator Call System - CKT “3JV”
- 16          • Emergency Onboard Communications Circuit – CKT “4JV”
- 17          • Public Address System – CKT “PA”
- 18          • Closed Circuit TV – CKT “CCTV”
- 19          • Ventilation Control System – CKT “VC”
- 20          • Whistle Operator Circuit – CKT “W”
- 21          • Sliding Watertight Door Control System - CKT “WD”
- 22          • Auxiliary Monitoring & Alarm System
- 23          • Main Propulsion Machinery Control and Alarm System

- Maneuvering Intercom Circuit – CKT “2MC”

2. Operate the Public Address (PA) System from all microphone stations, and note the sound level and clarity of speech at various locations throughout the Vessel. Perform this test at normal volume, and with the attenuators bypassed in the emergency position. In conjunction with the manufacturer’s service technician, adjust system for intensity and clarity. Announcements shall be clearly understandable at attenuated and non-attenuated sound levels.

Perform a frequency vs. dBa test of the PA System. Induce a fix frequency signal into the PA System from one (1) location, and measure the average sound intensity level over the entire Vessel. Perform this test at 100Hz, 1kHz, 2kHz, 4kHz, 8kHz and 12kHz. Record and tabulate all readings.

3. Test the General Alarm System from all operator stations. Record average sound intensity levels, dBa, at various locations throughout the Vessel. Adjust bells, including location and quantity, as necessary to meet USCG requirements for this system. Check all beacons for proper operation and visibility.

4. With guidance from the PSI Contractor, test the Propulsion Control System. A detailed, step-by-step procedure shall be developed using procedures and testing requirements provided by the PSI Contractor’s Main Engine Sub-contractor, Reduction Gear Sub-contractor, and CPP Propeller Sub-contractor.

The Propulsion Control System shall be tested from all locations, including the EOS and both Pilotheuses. All available features of the control system shall be tested from each location, including control transfer functions. All interlocks and automatic shutdown features shall be tested.

Speed and direction control shall be demonstrated to work properly for each control location.

The Contractor shall provide all personnel and crafts necessary to perform all tests. The Contractor shall provide for day shift, swing, or graveyard shifts for each Vessel as necessary to perform all testing.

#### **101.16.10 Batteries and Battery Chargers**

Check all batteries for secure mounting and proper ventilation. Ensure that no part of any battery touches any conductive part of the battery rack. Demonstrate proper operation of each batteries associated battery charger or power supply capability to recharge the battery in not over eight (8) hours. Perform this test by first performing an equalizing charge on the batteries, then discharging the batteries to the low limit of either minimum

voltage or minimum electrolyte specific gravity in accordance with manufacturer or USCG requirements, whichever applies, then energizing battery charger with normal load. Check charge (specific gravity) hourly, until full charge is achieved.

Record specific gravity readings of all cells during discharge and charging. Defective cells shall be replaced. Cells that prevent the battery from meeting any required ampacity and duration shall be replaced.

Verify all indications, alarms, interlocks and safety features associated with battery systems.

### **101.16.11 Switchboard Testing**

Verify that all installed systems operate as intended. This includes all system components, all safety devices, and all alarms, monitoring, and control devices.

Prepare Test Memoranda covering installation and operational tests using the following as a guide:

1. Conduct insulation resistance and continuity checks for all switchboard cabling in accordance with the *Cable Insulation Resistance* and *Circuit Continuity Checks* Subsections in this Section of the Technical Specification.
2. The installation/operational testing of Switchboards shall include, but not be limited to, the following:

#### **a. Visual Inspections**

1. Verify that the switchboard installation hook-up is in accordance with the Technical Specification and Drawings.
2. Check bonding (grounding) of cubicles and components of cubicles.
3. Check availability and marking of components in accordance with the relevant Drawings.
4. Verify the wire size and wire markers of all installed wires and cables.
5. Check bus bar torque.
6. Measuring of clearance, Electrical leakage on a solid dielectric surface and creepage (electrical leakage on a solid dielectric surface) distance of all installed wires and cables.

#### **b. Insulation Tests**

1. Measuring of clearance and creepage distance of all installed wires and cables.

2. Dielectric test of 480 Vac circuits.

3. Measurement of insulation resistance of all installed wires and cables.

**c. Functional Tests**

1. Check the withdrawal and insertion of draw out circuit breakers and contactors.

2. Check the operation of all grounding switches.

3. Check all mechanical interlocks.

4. Check current transformers.

5. Check Voltage transformers.

6. Check ground fault protection.

7. Check the interchangeability of components.

8. Functional test of control, measuring and protection circuits.

9. Functional test of alarm and monitoring sensors installed in switchboard.

10. Functional test of the 480 Vac circuits.

11. Verify the calibration of measuring instruments.

12. Verify the calibration of the protection devices.

All switchboard tests shall be conducted **prior** to Dock Trials.

**101.16.12 Alarm and Monitoring System**

The installation/operational tests of the Alarm and Monitoring System shall include, but not be limited to, the following:

**a. Visual Inspections**

1. Verify that the Alarm and Monitoring System installation hook-up is in accordance with the Technical Specification.

2. Check bonding (grounding) of cubicles and components of cubicles.

3. Check the availability and marking of components in accordance with the relevant drawings.

4. Verify wire size and the accuracy of the wire markers of all installed wires and cables.

**b. Insulation Tests**

1. Measuring of clearance and creepage distance of all installed wires and cables.

2. Measurement of insulation resistance of all installed wires and cables.

**c. Functional Tests**

1. The functional test of the Alarm and Monitoring System shall be included in the Integrated Test of Control Components.

**101.16.13 Homeland Security Video Monitoring and Detection System**

The installation/operational tests of the Homeland Security Video Monitoring and Detection System shall include, but not be limited to, the following:

**a. Visual Inspections**

1. Verify that the Homeland Security Video Monitoring and Detection System installation hook-up is in accordance with the Technical Specification.

2. Check bonding (grounding) of cubicles and components of cubicles.

3. Check the availability and marking of components in accordance with the relevant drawings.

4. Verify wire size and the accuracy of the wire markers of all installed wires and cables.

**b. Insulation Tests**

1. Measuring of clearance and creepage distance of all installed wires and cables.

2. Measurement of insulation resistance of all installed wires and cables.

**c. Functional Tests**

The functional test of the Homeland Security Video Monitoring and Detection System shall:

1. Demonstrate the full function of the system to meet the requirements of the system design.
2. Be conducted and certified by a factory trained representative.

#### **101.16.14 Smoke and Fire Detection Systems**

The installation/operational tests of the Smoke and Alarm Systems shall include, but not be limited to, the following:

##### **a. Visual Inspections**

1. Verify that the Smoke and Alarm Systems installation hook-up is in accordance with the Technical Specification.
2. Check bonding (grounding) of cubicles and components of cubicles.
3. Check the availability and marking of components in accordance with the relevant drawings.
4. Verify wire size and the accuracy of the wire markers of all installed wires and cables.

##### **c. Insulation Tests**

1. Measuring of clearance and creepage distance of all installed wires and cables.
2. Measurement of insulation resistance of all installed wires and cables.

##### **c. Functional Tests**

The functional test of the Smoke and Alarm Systems shall:

1. Demonstrate the full function of the system to meet the requirements of the system design.
2. Be conducted and certified by a factory trained representative.

All Smoke and Alarm Systems tests shall be satisfactorily conducted **prior** to Dock Trials.

#### **101.17 FIBER OPTIC CABLE INSTALLATION TESTING**

Unless specified differently in specific Sections of the Technical Specification, all new fiber optic cable installations, shall be tested as set forth in this Section of the Technical

Specification, the *FIBER OPTICS INSTALLATION* Subsection in Section 87 of the Technical Specification, and to the following requirements:

**a. Test Equipment Requirements**

1. Optical Time Domain Reflectometer (OTDR). The OTDR is used for estimating the attenuation rate of a fiber, and locating the nature and location of defects in an optical link.

**b. Specified Limits**

1. The cable is considered satisfactory if the maximum measured attenuation for each fiber does not exceed the vendor's attenuation data by greater than 1.0 dB/km.

**c. Acceptance/Pre-installation Tests**

1. Fiber optic cable and associated components shall undergo visual inspection prior to installation in the cableways to verify that it is mechanically sound. Inspect/test all fiber optic cable on the spool prior to making up the individual cables and after cable has been assembled with its end connections (prior to it being installed) with OTDR to verify it is optically sound and within specified limits.

**d. Installation Tests**

1. After the cable is installed in the cableways, the pre-installation tests shall be repeated to verify that fibers were not broken or damaged when the cable was pulled through the cableways.

**e. Post-Installation Tests**

1. After all fiber optic cable topology links have been installed, tests using optical inspection with OTDR, shall be conducted to verify that the end-to-end attenuation of the fiber optic cable topology is within specified limits.

After the Installation Test, the Contractor shall provide an Acceptance/Pre-installation Test Report which compares favorably with the Acceptance Report. The source of any abnormalities illuminated in this report shall be determined and corrected. After the Post-installation Test, the Contractor shall provide a report which shall compare favorably with the Installation Report. The source of any abnormalities illuminated in this report shall be determined and corrected.

**101.18 STABILITY TEST**

When the Work is essentially complete, conduct an inclining experiment to be witnessed by the WSF and the USCG. Prepare and conduct the test according to Reference (101E). Prepare the test report and submit copies to the WSF and USCG for review and approval in accordance with Section 100 of the Technical Specification.

This report shall be prepared using General Hydrostatics (GHS) software, published by Creative Systems, Seattle, Washington. The Contractor shall include in this submittal exact CD-ROM or DVD-ROM media files of both the report and supporting data.

**101.19 DOCK AND SEA TRIALS AGENDAS**

The Contractor shall prepare a separate agenda for each Trial detailed in this Subsection and the *DOCK TRIALS*, *PREPARATORY SEA TRIALS*, and *SEA TRIALS* Subsections of this Technical Specification. These agendas shall have a complete schedule of events, detailed event descriptions, step-by-step instructions for each event, and supporting event data sheets. The Contractor shall use Reference (101F) for guidance and shall include any tests or demonstrations required to show compliance with the Authoritative Agency requirements cited in References (101G) and (101H), or any other Technical Specification section making reference to "Trials".

In addition, the Preparatory Sea Trials and Sea Trials agendas shall give the following information:

1. List of riders, with their organizations, duties or responsibilities.
2. Instructions on emergency procedures (i.e., man overboard, collision, fire, abandon ship, etc.).
3. The location of Trial control.
4. The time and location of meals.

Each agenda shall be submitted to the WSF Representative no less than forty-five (45) days prior to the scheduled date of the Trial for review, comment and approval.

**NOTE:** See Final Dry-docking requirements prior to Dock Trials in Section 100 of the Technical Specification.

**101.20 DOCK TRIALS**

After all system operational tests have been satisfactorily completed, and the PSI Contractor has performed as much validation and calibration (commissioning) of Main Propulsion Systems and/or equipment as is possible dockside, and with the WSF Representative's



1 approval, the Contractor shall schedule and conduct Dock Trials. Dock Trials, upon  
2 satisfactory completion, shall have demonstrated that the Vessel is ready for subsequent  
3 Preparatory Sea Trials and Sea Trials in all respects.

4 For the Dock Trials event, the Vessel shall be in, and maintained in, a state of readiness to  
5 meet any emergency at sea such as collision, fire, man overboard, personnel injury, or  
6 grounding. That state of readiness shall, at a minimum, be:

- 7 1. Rescue Boats on board, properly stowed, and with operable davits.
- 8 2. High Slide Marine Evacuation Systems (MES), properly stowed, and operable.
- 9 3. Life rings and float lights in their designated stowage brackets.
- 10 4. Life jackets for all personnel, plus 5-percent (5%) spares on board and  
11 distributed in readily accessible areas.
- 12 5. A fully provisioned first aid kit and emergency medical equipment.

13 At the Contractor's discretion, Dock Trials may be performed at the dock, or away from the  
14 dock. In either case, there shall be a tug along side of sufficient size, horsepower and rigging  
15 to prevent the Vessel from incurring any damage should the loss or failure of one (1) or both  
16 Main Propulsion System(s) occur "at any power level".

17 The Contractor shall provide all paper, tissue, soap, and hotel service products required on  
18 the Vessel during Dock Trials.

19 The Contractor shall furnish all fuel and lube oils required to operate the Vessel during Dock  
20 Trials.

21 The Contractor shall provide a, WSF approved, competent Trial crew including a licensed  
22 Master for the Vessel tonnage, a Licensed Chief Engineer and Assistant certified for the type  
23 and horsepower of the propulsion plant, Oiler, and line handlers.

24 During Dock Trials, the Main Propulsion plant shall be operated for two (2) hours in each  
25 direction, two (2) hours each End in the "pulling" direction, and four (4) hours with each End  
26 "pushing". During each evolution, the Main Propulsion plant shall be operated at the highest  
27 power level obtainable, consistent with the mooring arrangement, dock, facility, or  
28 restrictions imposed on the Main Propulsion plant by dockside testing of this type (i.e., thrust  
29 bearing torque limits, abnormal power factors, etc.).

30 During Dock Trials, the Vessel's electrical power shall be from the normal source, with the  
31 exception of certain demonstrations involving the three (3) Ship's Service Diesel Generator  
32 Sets, and the Emergency Diesel Generator Set. All auxiliary equipment shall be operated

during Dock Trials with power from the normal source. Where duplicate units are provided, their run times shall be equally divided over the course of the trials. At a minimum Dock Trials, shall consist of the following events:

1. Operation of the Main Propulsion plant in one (1) direction.
2. Operation of the Main Propulsion plant with each End “pulling”.
3. Operation of the Main Propulsion plant with each End “pushing”.
4. Transfer of the Propulsion Plant Control System to and from all stations, with verification of control at each station, and a demonstration of any interlocks.
5. Operation of the Propulsion Plant from all control stations, in all control modes, including single Ended operations.
6. Demonstration of all steering units, from all control stations, in all modes, associated alarms, and verification of the agreement between local and remote indicators. It shall also be demonstrated that the position of the Pilothouse Control Console handles match the position of the rudders relative to the centerline of the Vessel.
7. Demonstration of all Navigational Systems and equipment, to include:
  - a. Whistle
  - b. Magnetic Compass
  - c. Gyrocompass
  - d. Satellite Compass
  - e. Radios
  - f. Radar
  - g. Automatic Draft Indication System (ADIST™)
  - h. Universal Automatic Identification System (UAIS)
  - i. Navigational Lights
  - j. Searchlights
  - k. Docking Lights
  - l. Window Wipers
  - m. Window Heaters
  - n. Global Positioning System (GPS)

- 1        8.    Ability of the Ship's Service Diesel Generator Sets to selected normal Vessel  
2            electrical loads.
- 3        9.    Ability of the Emergency Diesel Generator Set to pick up and maintain all  
4            emergency loads.
- 5        10.   Ability of the Temporary Emergency Power system(s) to supply and maintain  
6            emergency loads.
- 7        11.   In addition to the data required by the above events, the Contractor shall record  
8            pertinent main propulsion plant operating data at ¼ hour intervals throughout the  
9            course of the Dock Trials. All parameters shall be demonstrated to be within design  
10          limits for the operating condition. The Main Propulsion plant log sheets provided  
11          are to be used for guidance in determining the type of data WSF considers to be  
12          pertinent. Provide the WSF Representative with a true legible copy of all data  
13          records during the Dock Trials prior to delivery.

14    In addition to the above, *for the first Vessel only*, Main Propulsion plant casualty testing  
15    shall be performed as part of Dock Trials. For bidding purposes, the Contractor shall provide  
16    for as part of its bid, that during Dock Trials two (2) additional days will be allocated for  
17    propulsion plant casualty tests as specified by the PSI Contractor. All Contractor personnel  
18    necessary for full operation of the Main Propulsion plant during Dock Trials should be  
19    considered for bidding purposes. Main Propulsion plant casualty tests shall be included in  
20    the Dock Trials agenda.

21    All of the following tests shall be performed only after all protective devices have been  
22    properly calibrated and tested. All failures shall be simulated considering the full safety of  
23    the tested equipment.

24        1. Main Engine Tests:

- 25            • Failure of Main Engine auxiliary systems: cooling system, fuel system, etc.
- 26            • Failure of one (1) cylinder
- 27            • Failure of the electronic governor  
28              Failure of the mechanical governor (if provided)
- 29            • Failure of components installed on the diesel (sensors, coils, limit switches, etc.)
- 30            • Failure of manual start/stop devices installed on the diesel
- 31            • Failure of the diesel Local and Control Panel

2. Emergency Diesel Generator Switchboard Tests:

- Failure of a circuit breaker for alternator section
- Failure of the PLC located in switchboard
- Failure of the synchronization devices
- Failure of a bus tie circuit breaker

3. Ship's Service Diesel Generator Switchboard Tests:

- Failure of a circuit breaker for alternator section
- Failure of the PLC located in switchboard
- Failure of each of the synchronization devices
- Failure of a bus tie circuit breaker

4. Reduction Gear Tests:

- Failure of cooling water system
- Failure of lubrication system
- Failure of clutch control system

5. CPP Propeller Tests:

- Failure of hydraulic system
- Failure of cooling system
- Failure of control system

## **101.21 PREPARATORY SEA TRIALS**

The Contractor shall perform Preparatory Sea Trials as necessary for equipment and system pre-test, setup, and validation. These tests shall be used to determine that the systems are in working condition after successfully conducting the official Dock Trials and before conducting the official Sea Trials. The Trials shall be conducted under fair weather and sea conditions on the waters of Puget Sound.

The Contractor shall work in conjunction with the PSI Contractor to schedule the Preparatory Sea Trials to allow the PSI Contractor participation for the purpose of testing, adjusting,

1 trouble shooting and validating the various components of the Propulsion System and to aid  
2 the Contractor in running PSI Contractor equipment when necessary.

3 If any part of the Vessel or its Contractor provided equipment fails to meet contractual  
4 requirements during Trials, the Contractor shall conduct, at Contractor's expense, the  
5 additional tests and/or Trials necessary to satisfy contractual requirements.

6 All expenses for Preparatory Sea Trials and additional Tests and/or Trials as may be required  
7 by Contract shall be borne by the Contractor. The Contractor shall provide suitable  
8 accommodations and meals for all personnel aboard for trials. Meals shall be provided at  
9 normal breakfast (0500 to 0700 hours), lunch (1100 to 1300 hours), and dinner (1700 to 1900  
10 hours) times. If trials are conducted during these periods, at a minimum, breakfast and  
11 dinner shall be hot meals. All equipment and supplies necessary for Preparatory Sea Trials  
12 shall be provided by the Contractor, except for equipment, specified to be placed on board  
13 the Vessel by WSF, and as noted in the Technical Specification.

14 The Contractor shall provide all paper, tissue, soap, and hotel service products required on  
15 the Vessel during Preparatory Sea Trials.

16 The Contractor shall furnish all fuel and lube oils required to operate the Vessel during  
17 Preparatory Sea Trials.

18 The Contractor shall provide a, WSF Approved, competent Trial crew including a licensed  
19 Master and a Pilot certified for the waters navigated and the Vessel tonnage, a Licensed  
20 Chief Engineer and Assistant certified for the type and horsepower of the propulsion plant,  
21 Oiler, and line handlers.

22 The Vessel shall be in a state of material readiness to meet any possible emergency at sea  
23 such as collision, fire, man overboard, personnel injury, or grounding. The minimum  
24 readiness shall include:

- 25 1. Rescue boats and inflatable buoyant apparatus on board.
- 26 2. High Slide Marine Evacuation Systems (MES), properly stowed, and operable.
- 27 3. Life rings and float lights in stowage brackets.
- 28 4. Life jackets for all personnel, plus 5-percent (5%) spares shall be  
29 on board and properly distributed.
- 30 5. A first aid kit on board.
- 31 6. Firefighting systems shall have been satisfactorily demonstrated  
32 and all items properly stowed.

- 1        7. All navigation, navigating, and communications components and  
2        systems operational.

3        During Preparatory Sea Trials, representatives of WSF will exercise no actual control over  
4        the navigation or operation of the Vessel or its machinery plant or equipment. However, the  
5        WSF Representative may request additional operating parameters not in conflict with the  
6        established agenda and may bring to the Contractor's attention any method of operation that  
7        appears to conflict with the requirements of the Contract or which may be hazardous to the  
8        Vessel.

9        The following tests and corresponding adjustments will be performed:

- 10       1.    Paralleling and active load sharing between any two (2) of the three (3) Ships  
11       Service Diesel Generator Set combinations.
- 12       2.    Test and calibration check of all protection devices.
- 13       3.    Functional check of Ship's Service Switchboard at full load.
- 14       4.    Monitoring of diesels at full load.
- 15       5.    Functional check of the Propulsion System (Main Engines, Reduction Gears, CPP  
16       Propellers, shafting, shaft bearings, clutches).
- 17       6.    Full load test of the entire propulsion system approximately 90/10 load one (1)  
18       direction until the temperature stabilizes on all components. After cool-down the  
19       same test will be repeated for the other direction.
- 20       7.    Steering Gear and associated systems.
- 21       8.    Crash stop test. Adjust the protections to minimize the time to stop the shaft and  
22       the Vessel.

23       For estimating purposes, the Contractor shall consider that the above Main Propulsion plant  
24       testing will require a minimum of two (2) 16-hour days at sea followed by a minimum of one  
25       (1) day pier side followed by a minimum of an additional two (2) 16-hour days at sea.  
26       During these five days, in addition to providing all crew members required to safely operate  
27       the Vessel. The Contractor shall provide four (4) marine electricians and three (3) marine  
28       mechanics for the sole use of the PSI Contractor to assist in adjustment, calibration and  
29       repair of PSI Contractor supplied equipment.

In addition to the above, *for the first Vessel only*, Propulsion Plant Casualty Testing shall be performed as part of Preparatory Sea Trials. For bidding purposes, the Contractor shall provide for as part of its bid, that during the *first Vessel's* Preparatory Sea Trials one (1) additional day will be allocated for Propulsion Plant Casualty Tests as specified by the PSI Contractor's Representative. All Contractor personnel necessary for full operation of the Vessel during Preparatory Sea Trials should be considered for bidding purposes. Propulsion Plant Casualty Tests shall be included in the Preparatory Sea Trial agenda.

All of the following tests shall be performed only after all protective devices have been properly calibrated and tested. All failures shall be simulated considering the full safety of the tested equipment.

With the Vessel at Trial speed the following major component failures will be simulated one by one (by switching off or by stopping from full load):

1. Black-out simulation (all Ship's Service Diesel Generators stopped).

2. Failure of No. 1 Main Engine in front of the gate simulation.

3. Failure of No. 1 Main Engine during a crash stop simulation.

4. Failure of No. 2 Main Engine in front of the gate (landing at a terminal) simulation.

5. Failure of No. 2 Main Engine during a crash stop simulation.

## **101.22 SEA TRIALS**

After completion of successful Dock Trials and Preparatory Sea Trials, and when construction is substantially complete (except for WSF approved minor items of Work) and when the Vessel is ready for Sea Trials, the Contractor shall conduct Sea Trials in accordance with the test procedures and applicable sections of References (101B) and (101F). The Trials shall be conducted under fair weather and sea conditions on the inland waters of Puget Sound.

If any part of the Vessel or its equipment fails to meet contractual requirements during the Trials, the Contractor shall conduct, at Contractor's expense, those additional tests and/or Trials necessary to satisfy contractual requirements.

All expenses for Sea Trials and additional Tests and/or Trials as may be required by Contract shall be borne by the Contractor. The Contractor shall provide suitable accommodations and meals for all personnel aboard for Trials. Meals shall be provided at normal breakfast (0500 to 0700 hours), lunch (1100 to 1300 hours), and dinner (1600 to 1800 hours) times. At a

1 minimum, breakfast and dinner shall be hot meals. All equipment and supplies necessary for  
2 Sea Trials shall be provided by the Contractor, except for equipment specified to be placed  
3 on board the Vessel by WSF and as noted in the Technical Specification.

4 The Contractor shall also provide all paper, tissue, soap, and hotel service products required  
5 on the Vessel during Sea Trials.

6 The Contractor shall furnish all fuel and lube oils required to operate the Vessel during Sea  
7 Trials.

8 The Contractor shall provide a, WSF approved, competent Trials crew including a licensed  
9 Master and a Pilot certified for the waters navigated and the Vessel tonnage, a Licensed  
10 Chief Engineer and Assistant certified for the type and horsepower of the propulsion plant,  
11 Oiler, and line handlers.

12 The Vessel shall be in a state of material readiness to meet any possible emergency at sea  
13 such as collision, fire, man overboard, personnel injury, or grounding. The minimum  
14 readiness shall include:

- 15 1. Rescue Boats, and associated equipment and rigging on board, and operable.
- 16 2. High Slide Marine Evacuation Systems (MES), properly stowed, and operable.
- 17 3. Life rings and float lights in stowage brackets.
- 18 4. Life jackets for all personnel, plus 5-percent (>5%) spares shall  
19 be on board and properly distributed.
- 20 5. A first aid kit on board.
- 21 6. Firefighting systems shall have been satisfactorily demonstrated  
22 and all items properly stowed.
- 23 7. All navigation, navigating, and communications components and  
24 systems operational.

25 During Sea Trials, representatives of WSF will exercise no actual control over the navigation  
26 or operation of the Vessel or its machinery plant or equipment. However, the WSF  
27 Representative may request additional operating parameters not in conflict with the  
28 established agenda and may bring to the Contractor's attention any method of operation that  
29 appears to conflict with the requirements of the Contract or which may be hazardous to the  
30 Vessel.



In the event of an event stoppage during any endurance run, the decision to continue on with, restart, or reschedule a new endurance run shall be at the sole discretion of the WSF Representative based upon the circumstances and down time of the stoppage. Any restart or reschedule of a failed or interrupted endurance event shall be at the Contractor's sole expense and schedule. The decision of the WSF Representative will be final in all cases.

Sea Trials shall be conducted by the Contractor, who shall work in conjunction with the PSI Contractor and SSDG Contractor on each Vessel and shall be conducted in both directions (i.e., End No. 1 as forward and then End No. 2 as forward). During Sea Trials the PSI Contractor shall be responsible for the performance of his scope of supply, as set forth in the Propulsion System Integration Contract. Sea Trials shall consist of, but not be limited to, the following:

1. Rudder Response and Steering Trials with the propulsion plant at continuous service rating, ahead and astern rudders. Tests shall be of the dual redundant steering power units, on both ends of the Vessel. Tests shall be conducted a minimum of two (2) times from each control station.
2. Low Speed Controllability Maneuvers shall be conducted in both directions, from each control station.
3. Main Engine balancing prior to the full power run. Record final Electronic Fuel Injection (EFI) injector percent (%) opening settings, cylinder exhaust temperatures and firing pressures.
4. Full Power Endurance Runs, 100-percent (100%) continuous service rating each Main Engine for a period of not less than six (6) hours duration (three (3) hours per Vessel End). During the runs, fuel consumption shall be monitored by the EMDEC fuel consumption display for each Main Engine and by carefully recording soundings from the day tank with the FO purifier secured.
5. Progressive speed trials, in each direction, over the measured mile, both Ends.
6. Crabbing Tests shall be conducted with opposing propellers, at varied power settings, and rudders, a minimum of two (2) times from each control station, in each direction.
7. With only one (1) Main Engine on the line, determine the maximum Vessel speed and the associated stopping distance from that speed. Both Main Engines shall receive this test. Do not operate any Reduction Gear beyond its safe limits, whether those are operating parameters or time. This test may be performed from either Pilothouse with the Vessel in the ahead direction, and need only be performed once for each Reduction Gear. The duration of this event shall be at least fifteen (15)

minutes once the Main Propulsion plant has stabilized. Upon conclusion of the fifteen (15) minute period perform a crash reversal.

8. Single Main Engine operation runs shall be conducted in each direction. Runs of not less than sixty (60) minute duration shall be made at 100-percent (100%) continuous service rating, at 80-percent (80%) continuous service rating, and at 50-percent (50%) continuous service rating.

9. Both Main Engine operation runs shall be conducted in each direction. Runs of not less than sixty (60) minute duration shall be made at 100-percent (100%) continuous service rating, at 80-percent (80%) continuous service rating, and at 50-percent (50%) continuous service rating.

10. Two (2) Crash Reversal Tests shall be conducted in each direction with one (1) Main Engine on line from 100-percent (100%) continuous service rating ahead to 100-percent (100%) continuous service rating astern.

11. Two (2) Crash Reversal Tests shall be conducted in each direction with both Main Engines on line from 100-percent (100%) continuous service rating ahead to 100-percent (100%) continuous rating astern.

12. Operate the Main Propulsion plant from each control station in each available mode of operation. The Vessel direction shall be ahead at the maximum obtainable speed. The Main Propulsion plant shall be tested in both the Auto Control and Manual Control modes. Prepare a data sheet detailing each control station and mode of operation demonstrated and the results.

13. Adjustment, calibration and demonstration of the Vessel's magnetic and gyro compasses shall be accomplished.

14. Demonstration of the following navigation and communication systems and equipment:

a. Radios

b. Cellular telephones

c. Radar

d. Global Positioning System (GPS)

e. Universal Automatic Identification System (UAIS)

15. While underway, and on normal ship's power, demonstrate that the following features are satisfactory for all auxiliary equipment:

- a. Normal operation
- b. Transfer operations (as applicable)
- c. Remote start/stop features
- d. Local/remote indication

16. During the full power endurance run, the Contractor shall demonstrate that all general alarm bells are audible and function in accordance with this Technical Specification at each General Alarm bell location.

Measure and record first the background sound pressure level and then the sound pressure level with the general alarm bell "ringing".

Use a 1/1 octave sound level meter, recording at center frequencies between 20 and 10,000 Hz on the "A" weighted scale. An alternate method may be to use spectrum analyzing equipment, however the use of such equipment must be approved by the WSF Representative.

17. During the full power endurance run, the Contractor shall demonstrate that the public address system is audible in all spaces, including Vehicle Decks, Picklefork and Sun Deck areas, from each of the various microphone stations. Measure and record the sound level and note the quality of announcements.

18. During the full power endurance run sound pressure levels shall be measured and recorded in both Engine Rooms, EOS, Chief Engineer's Office, Engineer's Workshop, Engineer's Day Room, Reduction Gear Rooms, Tank Rooms, Port & Starboard Engineer's Storerooms, Engineer's Restroom, Upper and Lower Vehicle Decks, Passenger Deck, Sun Deck, Crew's Quarters, and each Pilothouse. Verify that the vibration and acoustical requirements of Sections 1, 7, 12, and 102 of the Technical Specification are met.

In the Engine Rooms, Chief Engineer's Office, Engineer's Day Room, Engineer's Workshop, and EOS, take measurements at several locations representative of normal occupancy during routine operation or servicing of machinery. During this survey, the space occupancy shall not exceed that which would be expected under normal watch standing conditions.

On the Passenger Deck and Sun Deck, with ventilation operating at full capacity, the measurements shall be taken at eight (8) locations (locations shall be

determined by the WSF Representative), and at least one (1) measurement in each space within the Passenger Deck (i.e., Food Vending areas, etc.).

In the Crew's Quarters and each Pilothouse, measure and record at least one (1) measurement representative of normal occupancy.

Also, on the Passenger Deck and Sun Deck, with the Emergency Diesel Generator operating at rated power, the Passenger Deck unoccupied, and ventilation secured, take and record measurements at several locations (locations shall be determined by the WSF Representative) directly adjacent to the Emergency Generator Room. This may be performed dockside.

The survey of the Engine Rooms, EOS, Engineer's Workshop, Engineer's Day Room, Reduction Gear Rooms, Tank Rooms, Port & Starboard Engineer's Storerooms, Engineer's Restroom, Passenger Deck, Sun Deck, Crews Quarters, and the Pilothouses, shall be performed once with End No. 1 pushing, and once with End No. 2 pushing.

Use a 1/1 octave sound level meter, recording at center frequencies between 20 and 10,000 Hz on the "A" weighted scale. An alternate method may be to use spectrum analyzing equipment, however the use of such equipment must be previously approved, in writing, by the WSF Representative.

Provide a "map" of all spaces surveyed, indicating the location where the measurement was made, along with three (3) copies of the recorded sound pressure levels prepared in tabular form.

Should any unacceptable sound levels be encountered, and are found to be the result of either an "unapproved deviation" from a Technical, Shipyard, or the Technical Specification, **or** an approved design and construction drawing, then the Contractor shall be responsible for, and make, any necessary corrections at their expense.

20. During full power with the maximum electrical load obtainable on the equipment to be surveyed, perform a thermo-graphic survey of the following:

- a. Emergency Switchboard.
- b. Ship's Service Switchboard.
- c. All Motor Controllers with controlled motors operating.
- d. All lighting and power panels
- e. All battery & battery charger connections.

During the thermo-graphic survey, the Contractor shall identify and record all anomalies observed. An anomaly shall be defined as a point on the conductors or connections which indicate a temperature differential from adjacent connections which are equally loaded, or exceeds prescribed temperature limits.

At the conclusion of Sea Trials the Contractor shall submit a list of anomalies to the WSF Representative. The Contractor shall make all repairs necessary to correct the anomalies and schedule a follow-up thermo-graphic survey with the Vessel on ship's power and with available ship's load, to demonstrate satisfactory correction of the anomalies, prior to delivery.

21. Demonstrate the ability of the Emergency Diesel Generator Set to assume the emergency load. This may be performed dockside at the conclusion of the Sea Trials.

22. Demonstrate the ability of the Emergency Diesel Generator Set to backfeed the Ship's Service Buss through the maintenance breaker circuit.

23. For the first Vessel of this Contract **only**, demonstrate bow wake and wave spray patterning while underway with the Vessel loaded down to the Design Load Waterline. This demonstration shall be demonstrated and measured at a minimum of six (6) different speeds, as determined by the WSF Representative. The Contractor shall provide color 8"×10" gloss photos and their digital files clearly showing bow wake and wave spray experienced, at each side of the Vessel while underway at the designated speeds from a chase craft, or approved equivalent. WSF would prefer that the weight brought onboard for this demonstration be provided on rubber tracked vehicle(s) with weight loaded on flatbeds so as not to damage the Lower Vehicle Deck surfaces. Any damage to the LVD surfaces caused by moving the weight on and off the Vessel shall be repaired by the Contractor's sole expense and schedule.

24. Perform a vibration analysis of the Propulsion System while at full power in both directions. This analysis shall include the Main Engines, Reduction Gears, engine output shafting, high speed shafting & bearings, and propulsion shafting. Obtain the services of an approved WSF vibration analysis contractor to perform this test.

25. As the last trials item of Sea Trials, perform a bow rudder "full-over" demonstration while underway at three (3) different speeds. Speeds for the "full-over" demonstration shall be at seven (7), fourteen (14), and eighteen (18) knots. Record for all three (3) speeds the result of this maneuver, and whether the rudder will return to the "0" position while underway at the prescribed speed.

Sea Trial test parameters shall include, but not be limited to, the following information:

- a. Date and time of each test.
- b. Ship speed and corresponding RPM, as required.
- c. Weather conditions (wind velocity and direction, sea state, etc.).
- d. Control Station in use.
- e. Vessel response times, if appropriate.
- f. End forward.
- g. Pressures and temperatures of diesel engines and auxiliary equipment.
- h. Test personnel involved.
- i. Identification of system and/or equipment tested.

Data taken during the progressive speed runs and full power endurance runs shall include, but not be limited to, the following for each Main Engine:

- a. Fuel oil pressure.
- b. Fuel oil temperature.
- c. Main Engine fuel EFI injector percent (%) capacity (opening) position.
- d. Fuel consumption as indicated by the EMPEC, or equal, Fuel Consumption Display.
- e. Engine exhaust temperatures for each cylinder.
- f. Engine RPM.
- g. Shaft RPMs (both bow and pushing shafts).
- h. Shaft HP for Main Engine and Propeller.
- i. Hi-speed and line shaft bearing temperatures.
- j. Jacket water entrance/exit temperatures.
- k. Air manifold pressure.
- l. Lube oil temperature.
- m. Propeller pitch setting.

n. All other parameters for which an indicator is provided.

The above data shall be recorded three (3) times during each timed run, at the beginning, the middle, and the end, and each 15 minutes during the full power endurance run. All other propulsion plant instruments, including auxiliaries shall be read and recorded at least once during the full power run. Propeller RPM varying in excess of 15 RPM or other data varying in excess of 5-percent (>5%) of the first reading taken in the speed run will constitute an unsatisfactory run. Such runs will be repeated at the discretion of the WSF Representative and at Contractor's expense.

Both propulsion shafts shall be fitted with shaft horsepower measuring devices accurate to plus or minus 0.5-percent ( $\pm 0.5\%$ ) for all test, or the installed indication may be used.

During the full power endurance runs the Contractor shall make every effort to locate and correct unsatisfactory vibration conditions and rattles in accommodation spaces and the Pilothouse emanating from sources such as doors, joiner panels, ceilings, windows, furniture, etc.

After completion, the Contractor shall prepare a report of Sea Trials. Three (3) copies of the preliminary report of Sea Trials shall be submitted to WSF prior to delivery of each Vessel. Three (3) copies of the final report of Sea Trials shall be delivered to the WSF Representative within thirty (30) days after delivery of each Vessel. The Contractor shall deliver the three (3) copies of the final report, on Mylar edge punched paper, bound in substantial loose leaf three (3) inch or less, "D"-ring double lock type 3-ring binders, with durable oil and water-repellent hard covers, suitably marked on the front cover and spine as to content.

### **101.23 COMPARTMENT CLOSE-OUT INSPECTIONS**

Compartment/Area Close-out Inspections shall be given the same status as a system test, and all the requirements, procedures, forms, notifications, scheduling, etc. of Section 100 of the Technical Specification shall apply.

When all Work in a compartment or exterior area has been completed, the Contractor shall request a joint inspection with the WSF Representative. Prerequisites to the joint inspection shall be Contractor's QA documentation certifying the Contractor satisfaction with the completion of Work, and as required below. The Contractor shall provide twenty-four (24) hours written notice in accordance with the requirements this Section and Section 100 of the Technical Specification. Compartments/Areas that have had prior Close-out Inspections shall be so indicated and the list of prior discrepancies **shall be** included with the notification. List all drawings and Engineering Change Notice(s) (ECN) applicable to the Work accomplished in the subject Compartment/Area. A written procedure for Compartment Close-out Inspection shall be submitted for approval as required by Section 100 of the Technical Specification.

Criteria for appropriate completion prior to Compartment/Area Close-out Inspections shall, at a minimum, include the following:

1. Compartments/Areas shall be complete with all supportive services pulled back and clear.
2. Crafts-persons shall have completed Work in the Compartment/Area and no on-going Work shall be underway during the inspection.
3. Compartments/Areas shall be totally outfitted as they will be in service.
4. Compartments/Areas shall be cleaned (includes decks waxed, paint dry, equipment dusted, windows washed, etc.).
5. Compartments/Areas being inspected shall be supported by all of the Vessel's services normally associated with them (i.e., ventilation, lighting, etc.).
6. Compartments/Areas which normally do not have lighting, or have low lighting levels (i.e. Voids, etc.) shall have adequate additional temporary lighting provided during the inspection.
7. Contractor shall have available a representative of each craft and/or subcontractor to clear minor discrepancies during the inspection when possible.
8. Contractor is able to close off access to the Compartments/Areas to preserve inspected condition.

Compartment Close-out Inspection shall be jointly conducted by the Contractor and the WSF Representative for each compartment and exterior area of the Vessel affected by the Work. The procedure for Compartment Close-out shall also include, but not be limited to, the following:

1. Assign a Contractor-furnished recorder to document any discrepancies noted during the Close-out Inspection.
2. Interior compartments without windows shall be fully illuminated by the Vessel lighting system within that compartment.
3. Exterior areas and interior compartments with windows shall be inspected during daylight hours only, and all Vessel lighting systems in the area shall be turned on during the Close-out Inspection.
4. On completion of the Close-out Inspection, the Contractor and the WSF Representative will review the Compartment Close-out Inspection document and discrepancy list, sign it, and date it.



The Contractor shall provide and use a compartment close-out document, and discrepancy list as a running inventory of discrepancies and shall assign responsibility for discrepancy correction. The Contractor shall provide and submit the above mentioned document and list to the WSF Representative, and update them continually until all compartments have been inspected and accepted by the WSF Representative.

#### **101.24 DESIGN VERIFICATION TESTING**

After successful completion of Dock and Preparatory Sea Trials, the Contractor shall provide data takers and schedule to assist the PSI Contractor perform Design Verification Testing of Vital System Automation in accordance with applicable parts of 46 CFR Part 61 and Part 62 and to the satisfaction of the USCG. Design Verification Testing that needs to be performed while the Vessel is underway shall be conducted as part of the Sea Trials (**not Preparatory Sea Trials**) and integrated into the Sea Trial Agenda by the Contractor.

The PSI Contractor will provide a Failure Analysis and Design Verification Test Procedure for those Propulsion System components and systems that are the direct responsibility of the PSI Contractor. The Contractor is responsible for all other Failure Analysis and test procedure development, and for integration and combination with the Propulsion System Failure Analysis and test procedure provided by the PSI Contractor.

#### **101.25 PHASE II TECHNICAL PROPOSAL REQUIREMENTS**

The following deliverables, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Test Program Plan

B. Preliminary List of Inspection, Test and Trial Memorandums and Events by title

Refer to *AUXILIARY SYSTEMS OPERATIONAL TESTS* Subsection in this Section of the Technical Specification for a further description of deliverables stated above. See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

#### **101.26 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS**

The following deliverables, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design and Construction stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Test Program Numbering System and Index and revisions

- 1 B. Test Program Network and Schedule and revisions
- 2 C. Test Program Status Reports and revisions
- 3 D. Inspection, Tests and Trials Memorandums and revisions
- 4 E. Compartment Close-out Checklists and revisions
- 5 F. Trial Memorandums and Agenda Booklets and revisions
- 6 G. Sea Trials Handbooks
- 7 H. Memorandum Reports and revisions
- 8 I. Dock Trials Report and revisions
- 9 J. Builders Sea Trial Report and revisions
- 10 K. Acceptance Trial Report and revisions
- 11 L. Factory Test Reports
- 12 M. Inclining Experiment Report
- 13 Refer to *AUXILIARY SYSTEMS OPERATIONAL TESTS* Subsection in this Section of the
- 14 Technical Specification for a further description of deliverables stated above. See
- 15 Section 100 of the Technical Specification for additional requirements regarding technical
- 16 documentation.

**(END OF SECTION)**